BC Centre for Disease Control
AN AGENCY OF THE PROVINCIAL HEALTH SERVICES AUTHORITY

TB

Annual Report 2014

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Summary of Trends

Tuberculosis (TB)

Active TB

- In 2014, the rate of active TB in BC was 6.3 per 100,000 population (290 cases), up from 6.0/100,000 population (273 cases) in 2013.
- Males continue to have higher active TB rates and an older age distribution of new TB diagnoses than females.
- In 2014, 81.4% of cases were among foreign born individuals, 7.5% were among Aboriginal peoples, and 11.0% were among Canadian-born non-Aboriginal people.
- Individuals born in the Western Pacific Region, South East Asian regions, and the Established Market regions comprised 59.3%, 30.1%, and 30.1% of foreign born cases, respectively, in 2014.
- In 2014, 90.0% of Active TB cases had known HIV status (up from 81.5% in 2013). Of cases with known status, 3.1% were co-infected with HIV in 2014.
- Drug resistant active TB is a concern world-wide, and rates of Isoniazid-resistant TB have generally increased in BC over the past decade. In 2014, 8.6% of all cases had Isoniazid resistance. Seven cases of multi-drug resistant TB (MDRTB) were seen in 2014 (2.4%), up from 0 in 2013.
- Of patients starting active TB treatment in 2014, 83.3% completed treatment, with 69.4% doing so within 1 year.

Latent TB Treatment

- A total of 802 individuals were started on LTBI therapy in 2014, of which 77.0% successfully completing treatment. The most common reason for LTBI therapy failure was adverse drug reaction and being lost to follow-up.

Contact Tracing

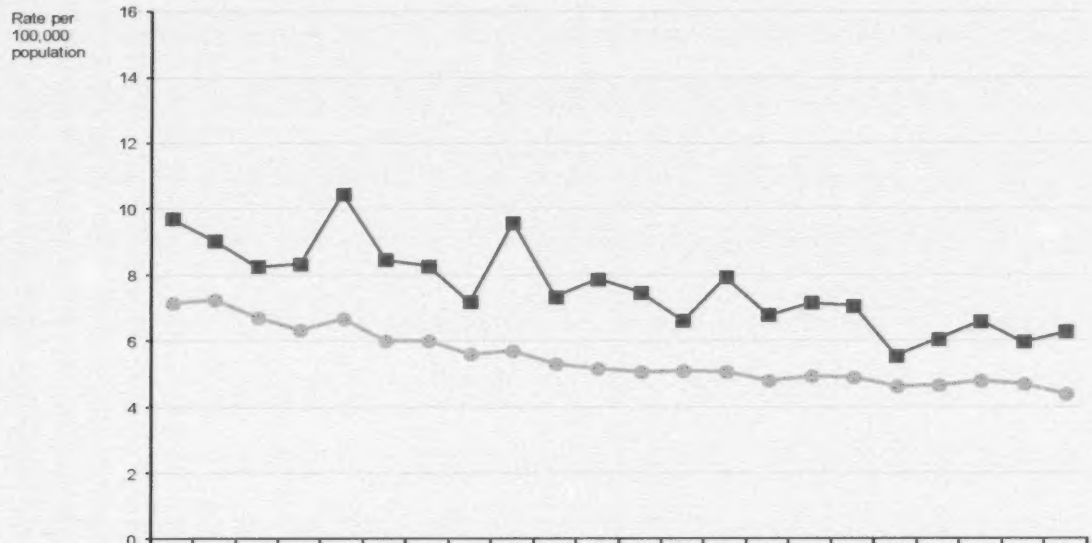
- In 2014, an average of 10.3 contacts (median=6.0) were documented per respiratory TB case. Of contacts documented in the Integrated Public Health Information System (iPHIS) in 2014, 43.0% were Type 1, 14.9% were Type 2, and 38.4% were Type 3.

A. Incidence and Case Totals

Active TB Historical Trends

The rate of active TB in British Columbia was 6.3/100,000 in 2014, up from 6.0/100,000 in 2013. The provincial rate of TB has generally decreased over the previous 2 decades. This trend mirrors that seen for Canada as a whole (Figure 1). The higher active TB rate observed in BC relative to the Canadian average likely stems from the large number of foreign-born individuals entering the province from high-incidence countries.[1] It must be noted that BC has a more inclusive case definition than does the Public Health Agency of Canada (PHAC), which may elevate our rates slightly compared to the Canadian rate (see Technical Appendix).

Figure 1. Active TB Disease rates in BC and Canada, 1993 to 2014



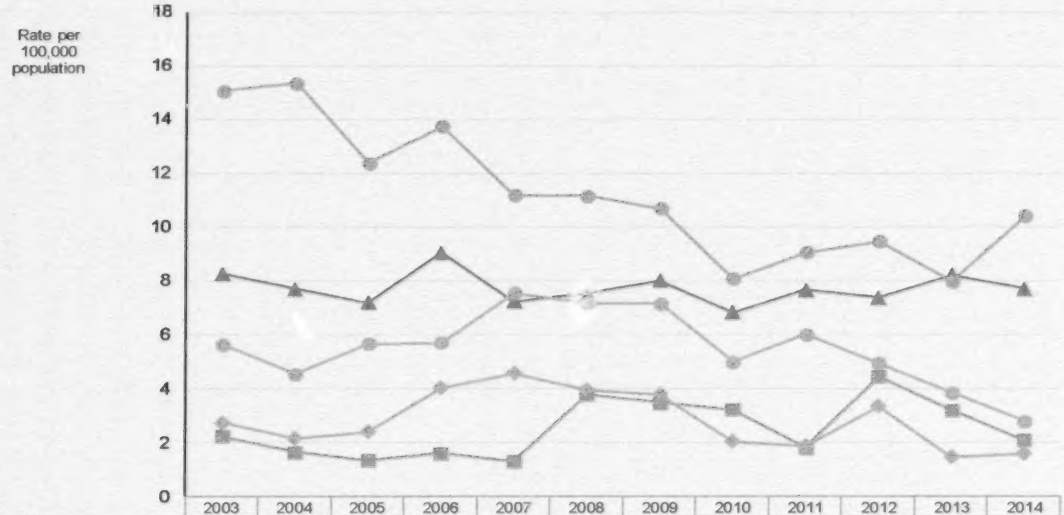
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
BC Diagnoses	346	332	312	323	413	337	332	290	391	300	324	310	277	336	292	313	315	251	277	299	273	290
BC Rate	9.7	9.0	8.3	8.3	10.5	8.5	8.3	7.2	9.6	7.3	7.9	7.5	6.6	7.9	6.8	7.1	7.1	5.5	6.1	6.6	6.0	6.3
Canadian Rate	7.2	7.3	6.7	6.3	6.7	6.0	6.0	5.6	5.7	5.3	5.2	5.0	5.1	5.0	4.8	4.9	4.9	4.6	4.7	4.8	4.7	4.4

* Canadian rates come from the Public Health Agency of Canada

Active TB Rates by Health Authority of Residence

In 2014, the rate of active TB was highest in Vancouver Coastal Health (10.4/100,000 population), followed by Fraser Health (7.7/100,000 population), Northern (2.8/100,000 population), Interior (2.1/100,000 population) and Vancouver Island (1.6/100,000 population) (Figure 2). The subtle peaks in active TB rates for Vancouver Island (2006-2009) and the Interior (2008-2010) were due to TB outbreaks documented during these periods.

Figure 2. Active TB Disease rates by Health Authority* in BC, 2003 to 2014



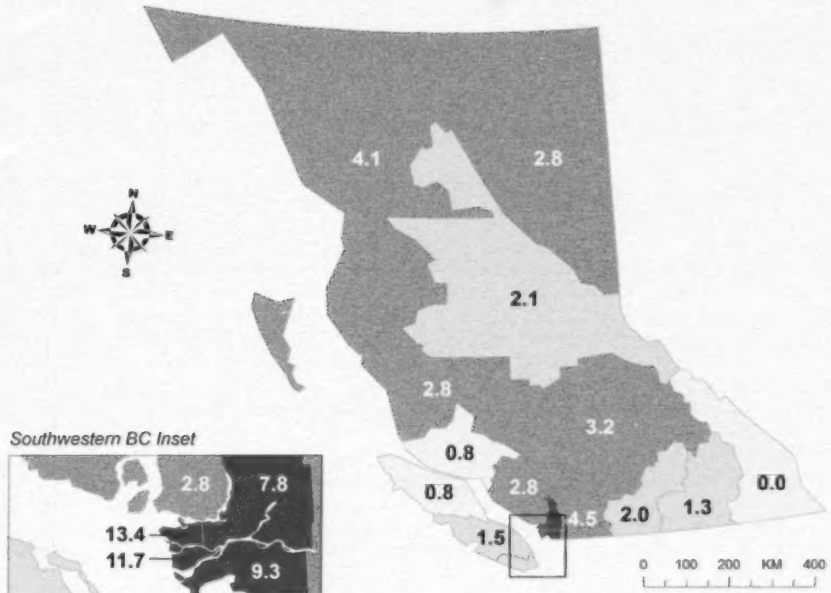
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Interior	2.2	1.6	1.3	1.6	1.3	3.8	3.5	3.2	1.8	4.4	3.2	2.1
Fraser	8.2	7.7	7.2	9.0	7.2	7.5	8.0	6.8	7.6	7.3	8.2	7.7
Vancouver Coastal	15.1	15.4	12.4	13.7	11.2	11.1	10.7	8.1	9.0	9.5	7.9	10.4
Vancouver Island	2.7	2.1	2.4	4.0	4.5	3.9	3.8	2.0	1.9	3.3	1.5	1.6
Northern	5.6	4.5	5.6	5.7	7.5	7.2	7.1	5.0	6.0	4.9	3.8	2.8

* Residence classified at time of case

Active TB Rates by Health Service Delivery Area

Vancouver had the highest rate of active TB in 2014 at 13.4/100,000 population, followed by Richmond (11.7/100,000 population), Fraser South (9.3/100,000 population) and Fraser North (7.8/100,000 population) Health Service Delivery Areas (HSDAs). The lowest active TB rates occurred in the East Kootenay (0.0/100,000 population) HSDA. (Figure 3)

Figure 3. Active TB Disease rates by Health Service Delivery Area*+ in BC, 2014



ID	Health Service Delivery Area	Cases	Rate
11	East Kootenay	0	0.0
12	Kootenay Boundary	1	1.3
13	Okanagan	7	2.0
14	Thompson Cariboo Shuswap	7	3.2
21	Fraser East	13	4.5
22	Fraser North	50	7.8
23	Fraser South	72	9.3
31	Richmond	24	11.7
32	Vancouver	88	13.4
33	North Shore/Coast Garibaldi	8	2.8
41	South Vancouver Island	7	1.9
42	Central Vancouver Island	4	1.5
43	North Vancouver Island	1	0.8
51	Northwest	3	4.1
52	Northern Interior	3	2.1
53	Northeast	2	2.8

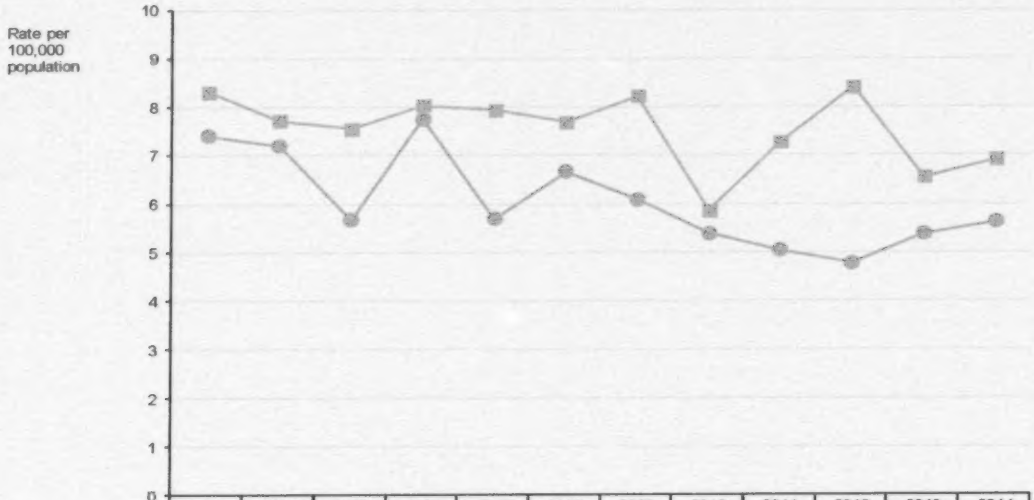
Rates calculated with population estimates released by BC Stats
* Health Service Delivery Area determined at time of case
+ Population denominators come from 2014 Population Estimates from BC Statistics.

Active TB by Age and Gender

The rate of active TB in men is consistently higher than in women (Figure 4). The rate of active TB in men in 2014 was 6.9/100,000 population, up from 6.5/100,000 population in 2013. The rate of active TB in females in 2014 was 5.6/100,000 population, compared to the rate of 5.4/100,000 seen in 2013.

In 2014, the greatest percentage of active TB cases in BC occurred in those 40-59 years of age (29.3%) and 60 years or older (42.1%). This older age distribution of cases is more pronounced in males than in females. In 2014, the highest rate of active TB in men was in those ≥60 years of age (14.3/100,000 population), followed by those 40-59 (7.1/100,000 population) (Figure 5). A different pattern is seen in women, with the highest rate occurring in those 25-30 years of age (9.6/100,000 population) followed by those ≥60 years of age (8.5/100,000 population) (Figure 5). Active disease in those <5 years of age indicates recent transmission because of the reduced probability of historic exposure and reactivation. Four cases of active TB were diagnosed in those <5 years of age in 2014, compared to three in 2013.

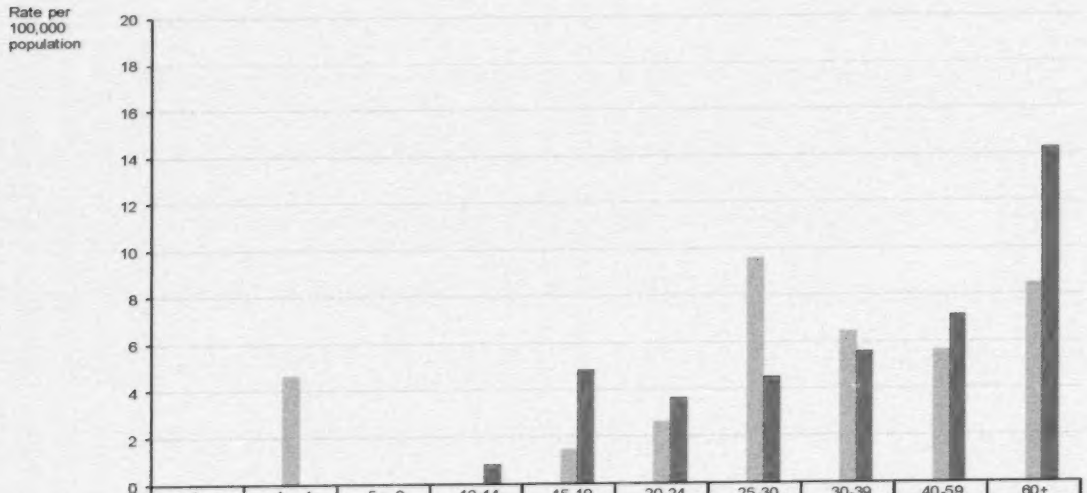
Figure 4. Active TB disease rates by gender in BC, 2003 to 2014



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Rate - Female	7.4	7.2	5.7	7.8	5.7	6.7	6.1	5.4	5.0	4.8	5.4	5.6
Rate - Male	8.3	7.7	7.6	8.0	7.9	7.7	8.2	5.9	7.3	8.4	6.5	6.9
Cases - Female	154	151	120	166	123	146	135	121	114	109	124	131
Cases - Male	170	159	157	169	169	166	180	130	163	190	149	159
Cases - Other *	0	0	0	1	0	0	0	0	0	0	0	0

* Other - transgender and gender unknown

Figure 5. Active TB disease rates by gender and age in BC for 2014

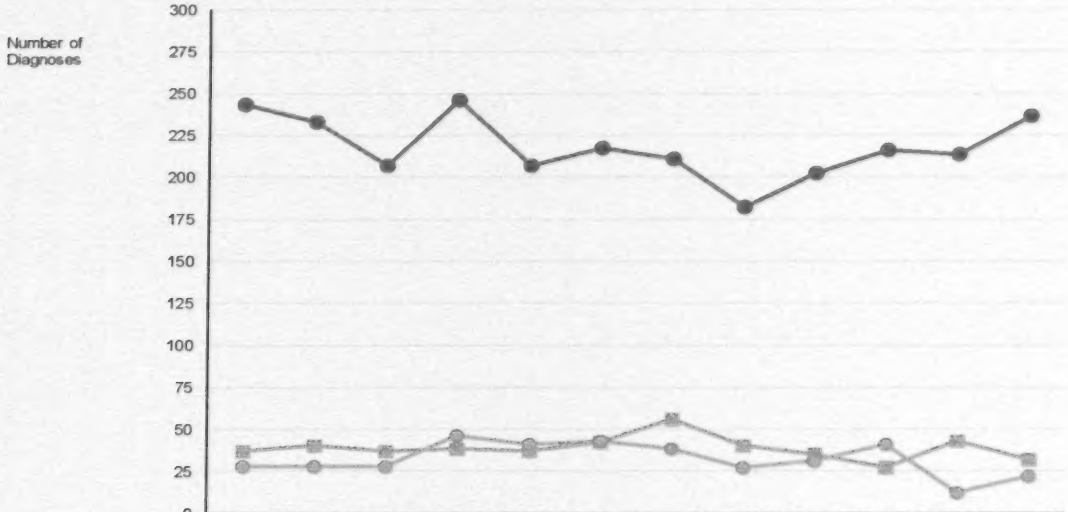


	< 1 yr	1 - 4	5 - 9	10-14	15-19	20-24	25-30	30-39	40-59	60+
Cases - Female	0	4	0	0	2	4	15	20	38	48
Cases - Male	0	0	0	1	7	6	7	17	47	74
Rates - Female	0.0	4.7	0.0	0.0	1.5	2.6	9.6	6.4	5.6	8.5
Rates - Male	0.0	0.0	0.0	0.8	4.8	3.6	4.5	5.6	7.1	14.3
Rates - Total	0.0	2.3	0.0	0.4	3.2	3.1	7.1	6.0	6.3	11.2

Active TB by Origin

In 2014, 236 cases (81.4%) of provincial cases occurred among foreign-born individuals, up from 78.5% (n=213) in 2013 (Figure. 6). In 2014, there were 22 cases (7.5%) in Aboriginal people, up from the 11-year low observed in 2013 (n=12). A total of 32 (11.0%) active TB cases were diagnosed in Canadian-born non-Aboriginal people in 2014, down from 43 in 2013.

Figure 6. Active TB disease total by origin in BC, 2003 to 2014



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Foreign Born	243	233	207	246	207	217	211	182	202	216	213	236
Can. Born-Non Abor.	37	40	37	38	37	42	56	40	35	27	43	32
Aboriginal Peoples	28	28	28	46	41	43	38	27	31	41	12	22
Unknown	16	9	5	6	7	10	10	2	9	15	5	0
TOTAL	324	310	277	336	292	312	315	251	277	299	273	290

Active TB among First Nations People

The disproportionate burden of TB in Aboriginal Peoples in Canada stems from social and structural cases affecting Aboriginal communities such as social inequity, discrimination, and a history of residential schooling.[2] These root causes contribute to factors affecting disease transmission and progression including overcrowding, poverty, malnutrition, difficulty in accessing healthcare in remote communities, and a distrust of TB treatment owing to the family disintegration that resulted from the historic use of TB treatment facilities or sanitaria.[3] Despite these challenges, it is critically important to realize that the majority of Aboriginal communities are not at risk for TB, and that Aboriginal Peoples have strong networks that can provide resources with which to prevent and control the disease.

The term Aboriginal Peoples is used in this report to describe people self-identified as Aboriginal at the time of diagnosis. In this section we present data for the subset of Aboriginal Peoples who identified as First Nations. Métis and Inuit peoples are excluded due to the small numbers (five or fewer TB cases were reported per year among Métis and Inuit people between 2003 and 2014) and the absence of population estimates for Métis and Inuit populations.

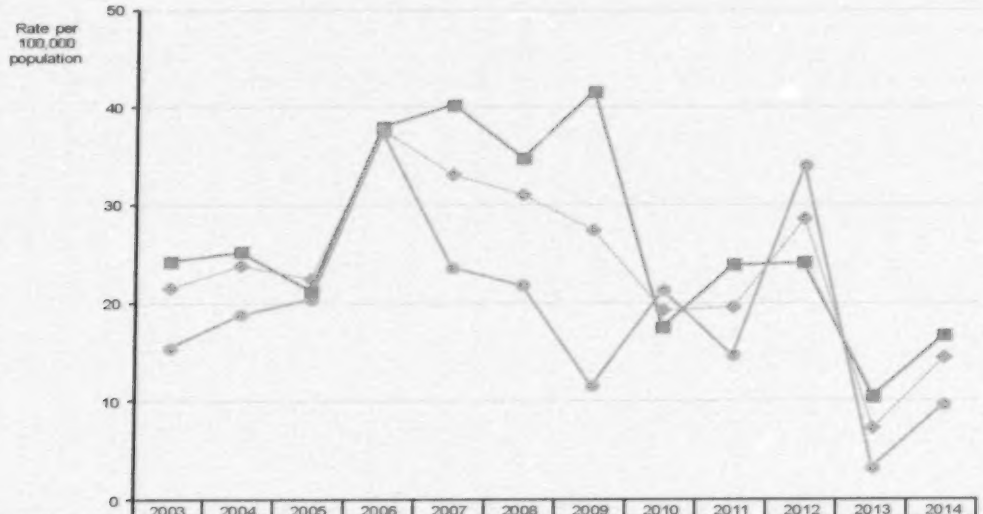
It should be noted that fluctuations in the TB rate among First Nations people is expected given the small number of cases annually. The rate of active TB in First Nations people in 2014 was 14.4/100,000 population, up from 7.2/100,000 population in 2013. The rate of active TB in First Nations people was steady between 2003 and 2005, but increased to 37.7/100,000 population in 2006, taking nearly four years to return to pre-2006 levels (Figure 10).

In 2014, the active TB rate among First Nations living on-reserve was (9.6/100,000 population), rising significantly from 2013 (3.2/100,000 population) (Figure 10). The active TB rate is typically higher among First Nations living off-reserve, and this is seen in 2014 with an off-reserve rate of 16.6/100,000.

The overall rate of active TB in First Nations males and females in 2014 was 21.6/100,000 population and 7.0/100,000 population, respectively. This is an increase from male and female active TB incidence in 2013, at 11.7/100,000 and 2.8/100,000 population, respectively.

There was only 1 case under 20 years of age diagnosed with active TB in 2014. The greatest percentage of cases occur in those 40-59 years of age (45.0%) and those greater than 60 years of age (35.0%) (Figure 8). The rate for males in 2014 was 63.7/100,000 population in those greater than 60 years of age, 32.6/100,000 population in those 40-59 year of age, 19.6/100,000 population in those 30-39 years of age, 15.4/100 000 population in those 20-24 years of age, and 17.2/100,000 population in those 15-19 years of age. In females, the incidence was 19.6/100,000 population in those 60 years of age and older, and 15.1/100,000 population in those 40-59 years of age and older.

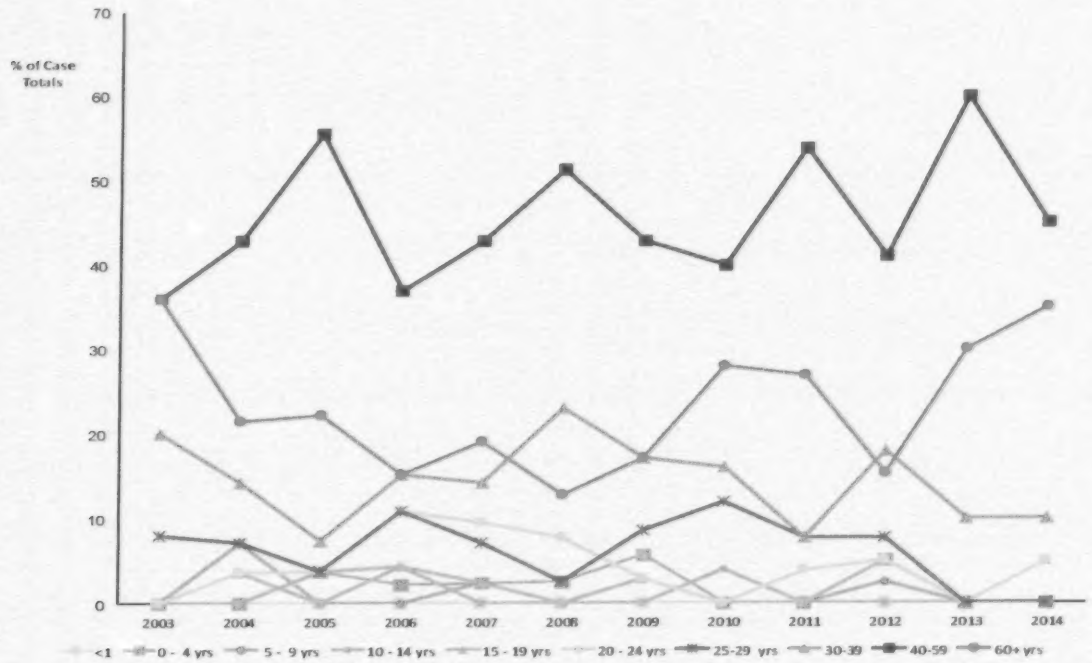
Figure 7. Active TB disease rates for First Nations peoples on and off reserve in BC, 2003 to 2014.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Rate - On Reserve	15.4	18.8	20.4	37.4	23.6	21.8	11.6	21.3	14.7	34.0	3.2	9.6
Rate - Off Reserve	24.2	25.2	21.2	38.0	40.2	34.8	41.6	17.5	23.8	24.1	10.5	16.6
Rate - Total (incl. unkn.)	21.5	23.7	22.5	37.7	33.1	31.0	27.4	19.3	19.6	28.6	7.2	14.4

* Unknown Residence - has no on reserve status listed
Rates based on First Nations population estimates from Aboriginal Affairs and Northern Development Canada (AANDC)

Figure 8. Percentage of total active TB disease cases for First Nations peoples in BC by age groupings, 2003 to 2014



Active TB among Foreign-born Populations

Between 2003 and 2014, 73.5% of active TB cases in BC occurred in the foreign-born population (n=3529) (Figure 6). This is not unique to BC as the foreign-born population in Canada has a rate of active TB that is 13 times that of Canadian-born non-Aboriginal Peoples.[4] Many of BC's recent immigrants come from regions with high rates of active TB such as the South-east Asia and Western Pacific regions as defined by PHAC[1,5]. Citizenship and Immigration Canada (CIC) currently screen immigrants applying for permanent residency for active TB, as well as all students, visitors or workers staying for more than 6 months.[6] Visitors, students or workers staying less than 6 months do not undergo screening.

The highest numbers of active TB cases in foreign-born population in BC consistently occur in groups from the Western Pacific region followed and the South East Asian Region[1] (Figure 9); in 2014, there were 140 and 71 cases from these regions, respectively, representing 89.4% of all foreign-born TB cases. Fewer than 30 cases of active TB were diagnosed in individuals from all of the other PHAC regions.

In 2014, foreign-born cases of active TB were older (median: 52.0 years) than non-foreign-born cases (median: 48.0 years). In 2014, 53.1% of foreign-born cases were male. The age breakdown of foreign-born active TB cases is similar to that of provincial totals, with 45.6% of foreign-born cases occurring in those over 60 years of age and with 14.0% between 40-59 years of age (Figure 10).

Figure 9. Percentage of total active TB disease cases for foreign-born peoples by PHAC region in BC, 2003 to 2014

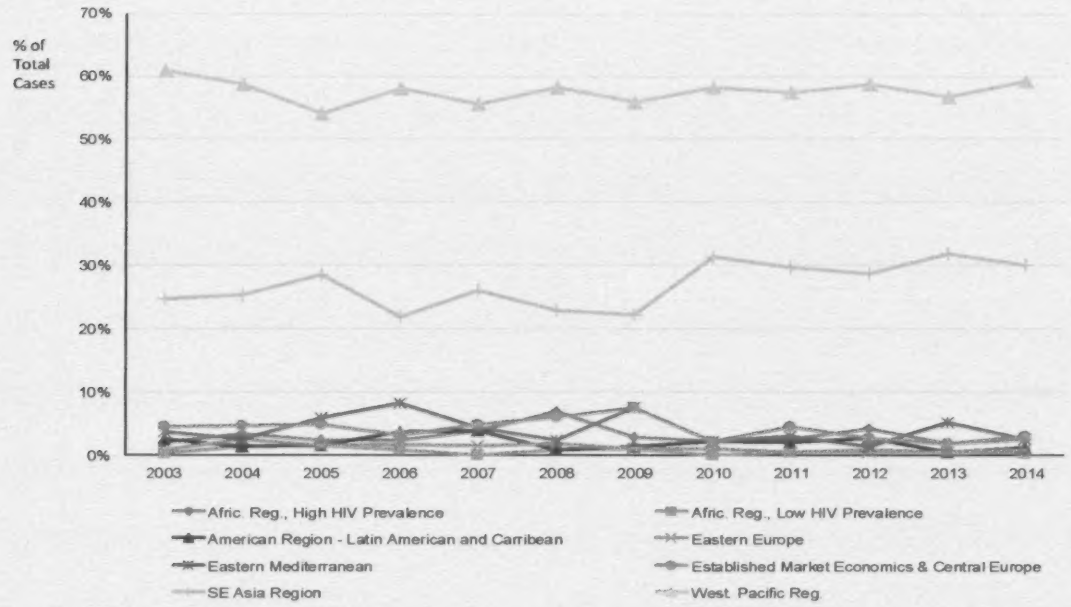
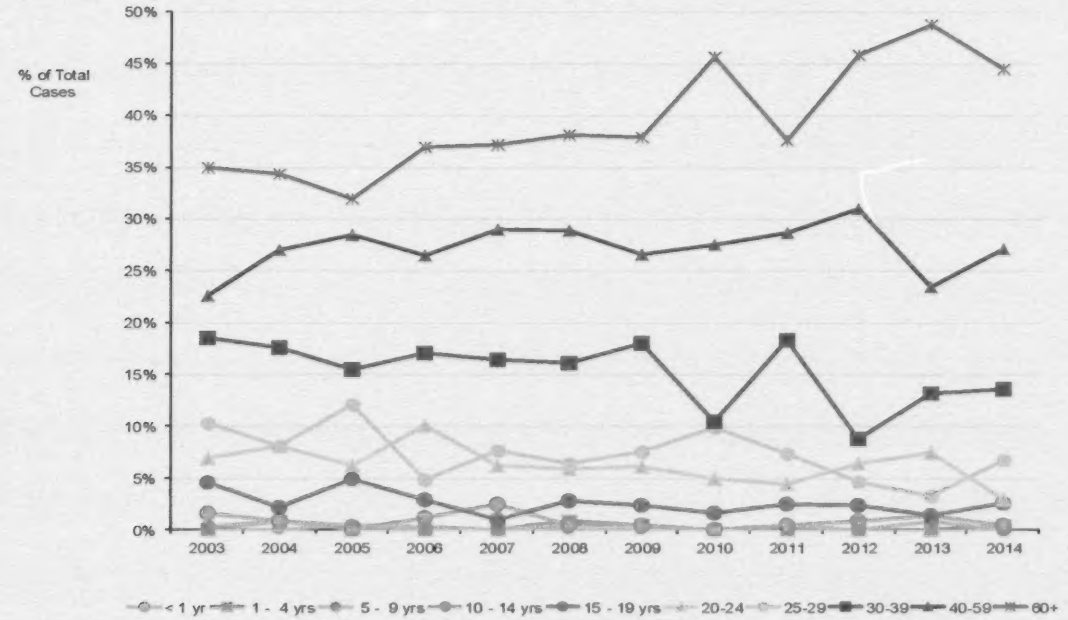


Figure 10. Percentage of total active TB disease cases for foreign-born peoples in BC by age groupings, 2003 to 2014



Site of Disease

The site of active TB describes the clinical location of TB disease. Respiratory infection is more transmissible than non-respiratory infection[7]. In 2014, 79.7% (n=231) of active TB cases were respiratory, down from 83.2% (n=227) in 2013 (Figure 11). Of respiratory cases in 2014, 93.9% were pulmonary, 3.0% were classified as other respiratory, 2.2% were miliary, and 0.9% were diagnosed as primary infections (Table 1). Of the respiratory cases in 2014, 15.2% (n=35) were cavitary, up from 9.8% (n=22) in 2013. Yearly fluctuations are likely driven by small numbers (Table 2).

In 2014, 20.3% (n=59) of cases were non-respiratory, compared to 16.8% (n=46) of cases in 2013. That pattern observed in 2014 is consistent with the historic trend. Of the non-respiratory cases in 2014, 69.5% (n=41) occurred in the Peripheral Lymph Nodes, 1.7% (n=1) occurred in the meninges and central nervous system (CNS), and 28.8% (n=17) were classified as other (Table 1).

Figure 11. Cases of respiratory and non-respiratory TB, 2003 to 2014

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cases - Total Resp.*	230	223	198	250	230	249	241	196	214	242	227	231
Cases - Total Non-Resp.	94	87	79	86	62	64	74	55	63	57	46	59
% - Total Resp.	71.0	71.9	71.5	74.4	78.8	79.6	76.5	78.1	77.3	80.9	83.2	79.7
% - Total Non-Resp.	29.0	28.1	28.5	25.6	21.2	20.4	23.5	21.9	22.7	19.1	16.8	20.3

* Respiratory includes all cases classified as pulmonary, primary, miliary, and other pulmonary.

Table 1. Percentage of total active TB cases by site classification in BC, 2003 to 2014

% of Total Cases	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Respiratory												
% Primary	2.2	4.0	2.0	2.8	0.4	1.6	2.1	2.0	0.5	1.2	1.3	0.9
% Pulmonary	89.1	85.7	88.4	86.8	89.1	92.8	90.5	89.8	92.1	90.5	88.5	93.9
% Miliary	1.7	1.3	0.0	0.0	0.0	0.0	0.8	1.0	3.3	0.8	2.6	2.2
% Other	7.0	9.0	9.6	10.4	10.4	5.6	6.6	7.1	4.2	7.4	7.5	3.0
% - Total Resp.	***71.0***	***71.9***	***71.5***	***74.4***	***78.8***	***79.6***	***76.5***	***78.1***	***77.3***	***80.9***	***83.2***	***79.7***
Non-Respiratory												
% Meninges and CNS	5.3	5.7	6.3	4.7	8.1	1.6	6.8	7.3	3.2	1.8	4.3	1.7
% Peripheral Lymph Node	58.5	49.4	46.8	61.6	53.2	43.8	51.4	61.8	60.3	49.1	39.1	69.5
% Other	36.2	44.8	46.8	33.7	38.7	54.7	41.9	30.9	36.5	49.1	56.5	28.8
% - Total Non-Resp.	***29.0***	***28.1***	***28.5***	***25.6***	***21.2***	***20.4***	***23.5***	***21.9***	***22.7***	***19.1***	***16.8***	***20.3***
Unknown Cases	0	0	0	0	0	0	0	0	1	0	0	0
Total Cases	**324**	**310**	**277**	**336**	**292**	**312**	**315**	**251**	**277**	**299**	**273**	**290**

Degree of Smear Positivity

All cases of respiratory active disease have a sample collected for rapid smear testing. Smear positivity characterizes the infectiousness of a given patient with the Acid Fast Bacteria (AFB) classification signifying the quantity of bacteria contained in a sample; hence AFB 3+ or 4+ patients are usually more infectious than AFB 1+ or 2+ patients.[7]

In 2014, 26.0% (n=60) of active respiratory cases were smear 3 or 4+ positive, up from 22.2% (n=50) in 2013 (Figure 12). The percentage of total smear positive (AFB 1 or 2+, AFB 3 or 4+ and other) respiratory cases increased from 53.8% in 2013 to 56.7% in 2014.

Figure 12. Percentage smear results of all respiratory cases in BC, 2003 to 2014

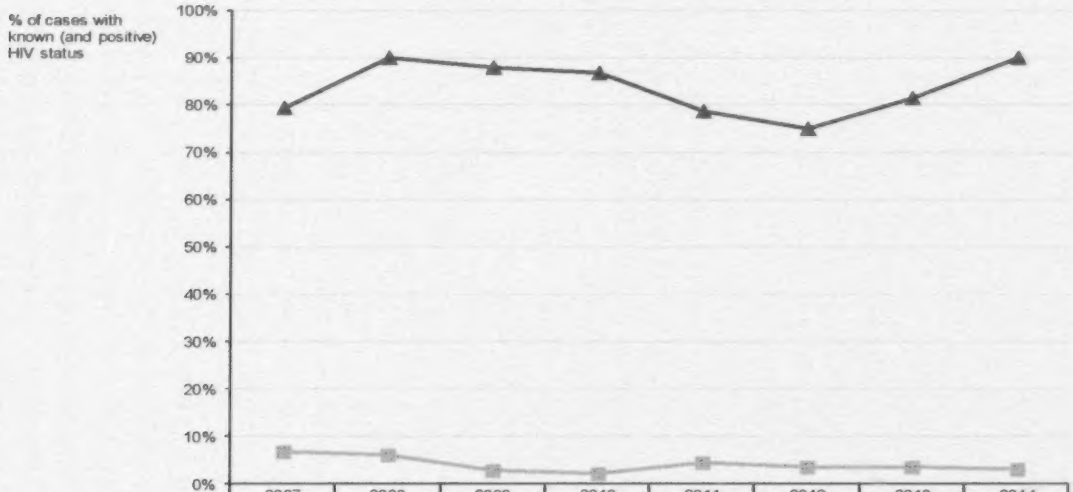
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
% - AFB1/2+*	37.4	28.3	34.8	22.0	28.7	25.8	22.0	24.0	29.0	29.8	31.6	30.7
% - AFB 3/4+	5.2	18.8	21.7	21.2	17.4	26.2	27.0	21.4	21.0	25.2	22.2	26.0
% - Smear Negative	57.4	52.9	43.4	56.8	53.9	48.0	51.0	54.6	50.0	45.0	46.2	43.3
% - Other	0.0	1.0	1.8	0.0	0.0	0.8	1.7	0.0	2.8	0.0	2.5	0.0
Cases - AFB1/2+*	86	63	69	55	66	64	53	47	62	72	71	71
Cases - AFB 3/4+	12	42	43	53	40	65	65	42	45	61	50	60
Cases - Smear Negative	132	118	86	142	124	119	123	107	107	109	104	100
Cases - Other	0	1	2	0	0	1	2	0	3	0	3	0

* This category also contains a small number of cases with "positive" or "seen".

HIV Screening and Co-infection

Only data collected 2007 or later is presented here because HIV data was previously not routinely collected for all TB cases. In 2014, 90.0% of TB cases had known HIV status (including self-reported), up from 81.5% in 2013. Of those with known status, 3.1% had HIV infection in 2014 as indicated by self report or lab report, down slightly from 3.6% observed for 2013 (Figure 13). The decreasing percentage of HIV positive active TB cases since 2007 may partially result from increases in the availability and use of anti-retroviral medications in the province, resulting in an elevated CD4 count and a decreased probability of TB activation in HIV infected patients.

Figure 13. Percentage of active TB Cases with known HIV status in BC, 2007 to 2014



	2007	2008	2009	2010	2011	2012	2013	2014
% - Positive*	6.9	6.0	2.9	2.3	4.6	3.6	3.6	3.1
% - Known Status#	79.5	90.1	87.9	86.9	78.7	74.9	81.5	90.0
Total - Positive	16	17	8	5	10	8	8	8
Cases - Status Known	232	281	277	218	218	224	220	261

Known status includes results from testing, as well as self-reported status
* % positive of those with known status

B. Treatment of Active Cases

Number of Active Cases Starting Treatment

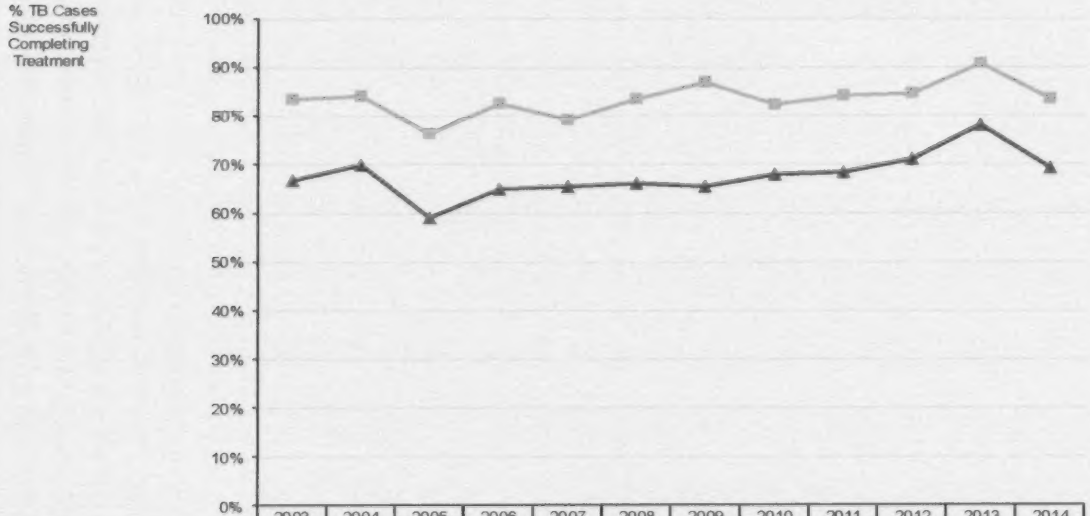
Here we present data on the percentage of cases starting treatment (excluding those diagnosed post-mortem (n=8)). In this group, the percentage of active cases starting treatment in BC has remained above 97% since 2003. In 2014, 100% of all active cases started treatment, up from 98.8% in 2013. Of those who started treatment, 61.0% did so as outpatients, with 75.1% of all treatment starts being self-administered.

Treatment Completion

In 2014, 83.3% percent of patients starting treatment successfully completed treatment, with 69.1% doing so within 12 months (Figure 14). This was down from 90.7% successfully completing treatment in 2013 (77.9% in 12 months).

Of those patients who did not complete active TB treatment in 2014 (n=38, excluding those who died pre-treatment), 10.5% were non-adherent, 13.2% were lost to follow-up, 2.6% had drug reactions, 31.6% left the province, and 36.8% had no information on reason for treatment completion (Table 2). Note that the percentage of clients leaving the province is much greater than in 2013 (17.4%), which may partially explain the lower provincial treatment completion percentages.

Figure 14. Percentage of active TB Cases# by treatment success in BC, 2003 to 2014



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
% - Successful*	83.5	84.1	76.1	82.5	79.1	83.5	86.9	82.3	84.2	84.7	90.7	83.3
% - Succ. within 12 Months	66.7	69.8	59.0	64.9	65.3	66.0	65.4	67.9	68.3	71.1	77.9	69.1

Data does not include those individuals dying during the course of treatment, or those having left the province during treatment.
* Successful treatment indicated solely by iPHIS indicator with no associated time frame

Table 2. Percentage of documented treatment failures in BC by reason for failure, 2003 to 2014

Reason for Non-Completion	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Drug Reaction	4.3	10.8	3.6	2.0	2.0	2.3	6.5	8.7	6.9	9.4	8.7	2.6
Left Province	31.9	18.9	25.5	28.6	37.3	34.1	16.1	34.8	41.4	18.8	17.4	31.6
Lost to Followup	12.8	13.5	18.2	24.5	17.6	11.4	16.1	21.7	3.4	6.3	0.0	13.2
Non-Adherence	17.0	29.7	30.9	16.3	9.8	11.4	25.8	13.0	6.9	21.9	8.7	10.5
No Data	31.9	24.3	16.4	26.5	29.4	36.4	29.0	8.7	41.4	40.6	65.2	36.8
Other	2.1	2.7	5.5	2.0	3.9	4.5	6.5	13.0	0.0	3.1	0.0	5.3
# Unsatisfactory Compl.	**47**	**37**	**55**	**49**	**51**	**44**	**31**	**23**	**29**	**32**	**23**	**38**

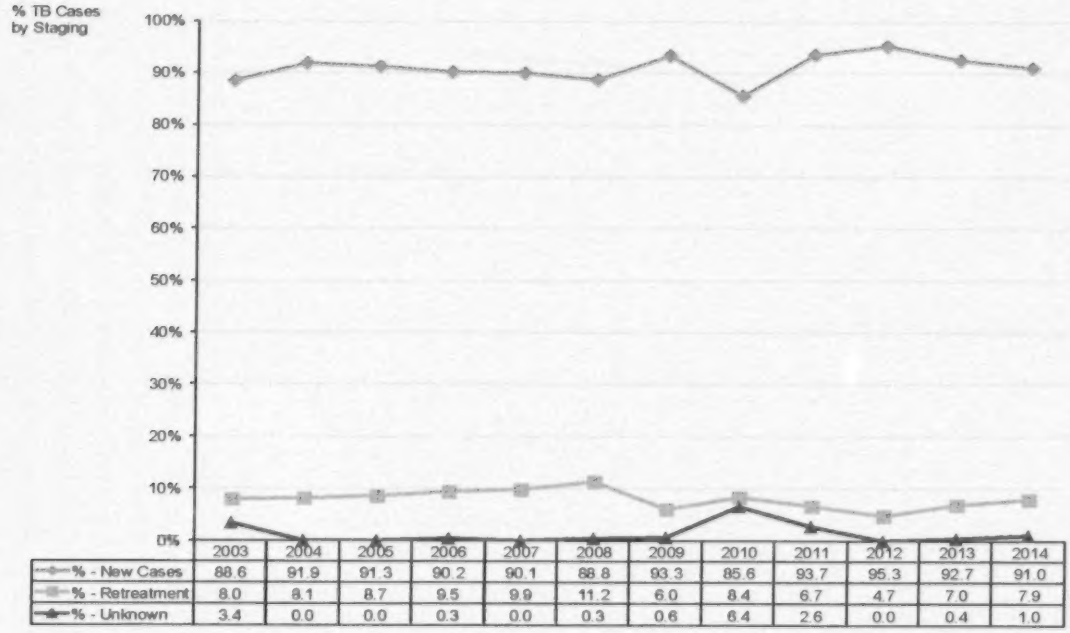
This data includes only information on those individuals who did not complete treatment, and does not include those who died during treatment.

* Lags in the recording of treatment completion information may inflate the % of unknown outcomes in most recent year

Retreatment

Retreatment cases are clients who have active disease with documented evidence of previous active disease in BC or elsewhere. The majority of active TB cases in BC between 2003 and 2014 represent initial reactivation of latent TB or novel infection. In 2014, 91.0% of active cases were documented as new cases of active disease, down from 92.7% in 2013 (Figure 15). Only 7.9% (n=23) of cases were determined to be retreatment of previous disease, up from 7.0% in 2013. In 2014, 78.3% (n=18) of retreatment occurred in the foreign-born population, down from 92.7% in 2013. In 2014, 69.6% of retreatment cases occurred in those >60 years of age, and 17.4% of cases occurring in those 40-59 years of age. In 2014, 65.2% of retreatment occurred in males, down from 89.7% in 2013.

Figure 15. Percentage of total TB cases diagnosed as retreatment in BC for 2003-2014



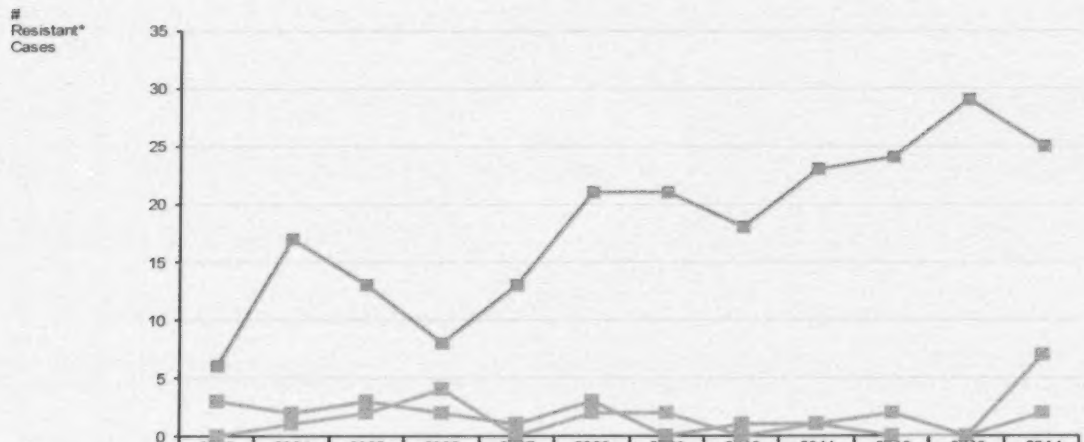
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
% - New Cases	88.6	91.9	91.3	90.2	90.1	88.8	93.3	85.6	93.7	95.3	92.7	91.0
% - Retreatment	8.0	8.1	8.7	9.5	9.9	11.2	6.0	8.4	6.7	4.7	7.0	7.9
% - Unknown	3.4	0.0	0.0	0.3	0.0	0.3	0.6	6.4	2.6	0.0	0.4	1.0

Drug Resistance

Drug resistance remains an important issue given increases in both the worldwide rates of drug resistance[8] and the number of immigrants from countries with high-rates of endemic TB. Cases of Isoniazid resistant TB in BC have generally increased over the last 10 years, although the percentage of cases with only Isoniazid resistance decreased from 10.6% (n=29) in 2013 to 8.6% (n=25) in 2014 (Figure 16).

Multi-Drug Resistant TB (MDRTB, which is identified as combined Isoniazid and Rifampin resistance) diagnoses increased to 7 cases seen in 2014, up from 0 in 2013 (Figure 16). No extensively drug resistant TB (XDRTB) has been diagnosed in BC.

Figure 16. Number of total cases with drug resistance in BC, 2003 to 2014



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cases - Isoniazid	6	17	13	8	13	21	21	18	23	24	29	25
Cases - Rifampin	0	1	2	4	0	2	2	0	1	0	0	2
Cases - Both	3	2	3	2	1	3	0	1	1	2	0	7
Total	324	310	277	336	292	312	315	250	277	299	273	290
% - Isoniazid	1.9	5.5	4.7	2.4	4.5	6.7	6.7	7.2	8.3	8.0	10.6	8.6
% - Rifampin	0.0	0.3	0.7	1.2	0.0	0.6	0.6	0.0	0.4	0.0	0.0	0.7
% - Both	0.9	0.6	1.1	0.6	0.3	1.0	0.0	0.4	0.4	0.7	0.0	2.4

*Resistance to drugs other than Isoniazid or Rifampin is not represented here.

C. Mortality in Active TB Cases

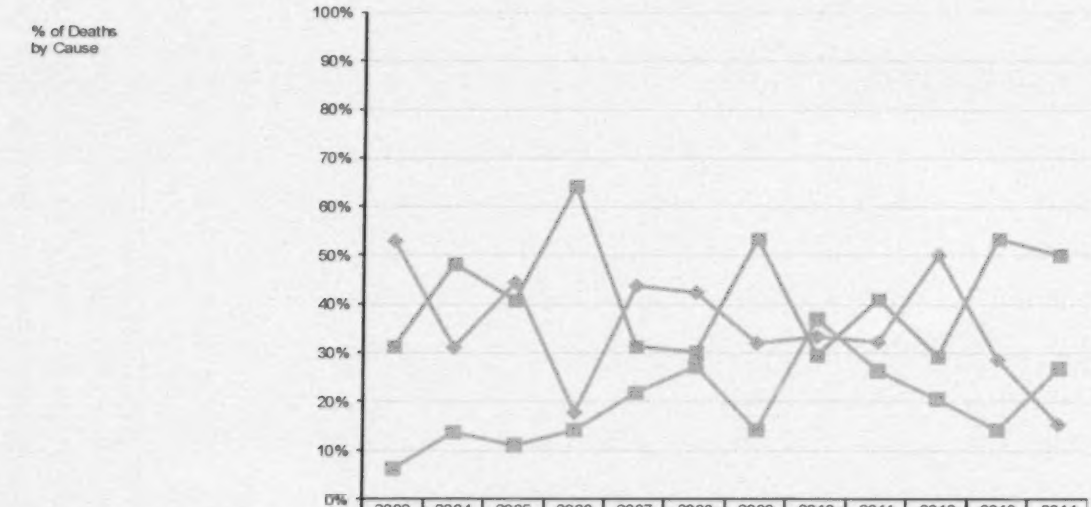
Mortality

In 2014, there were 26 deaths amongst active TB cases documented in iPHIS (see Appendix). Of these, 8 were diagnosed post-mortem and 17 cases died during active TB treatment. The total number of deaths in TB cases in iPHIS decreased in 2014 compared to 2013 (n=28).

Of the 26 deaths occurring in active TB cases in 2014, 61.5% (n=16) were male and 38.5% (n=10) were female. The higher mortality in men is consistent with provincial totals since 2004. A single deaths occurred in those under 25.

Of the 26 deaths documented in 2014, 15.4% (n=4) were unrelated to active TB disease. TB was the underlying cause of death in 26.9% (n=7) of documented deaths, and contributed to, but was not the underlying cause, in 50.0% (n=13) of cases (Figure 17). Note that variability in the percentage of deaths for which active TB was an unrelated or contributing cause is likely indicative of a combination of small numbers and coding issues, and may not reflect true mortality patterns (Figure 17).

Figure 17. Percent of total mortality by cause in BC, 2003 to 2014



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
% - TB contributed, not underlying cause of death	31.3	48.3	40.7	64.3	31.3	30.3	53.6	29.6	41.2	29.4	53.6	50.0
% - TB underlying cause of death	6.3	13.8	11.1	14.3	21.9	27.3	14.3	37.0	26.5	20.6	14.3	26.9
% - TB Unrelated to death	53.1	31.0	44.4	17.9	43.8	42.4	32.1	33.3	32.4	50.0	28.6	15.4
Unknown	9.4	6.9	3.7	3.6	3.1	0.0	0.0	0.0	0.0	0.0	3.6	7.7

Latent TB Treatment

LTBI is a clinical diagnosis in which an individual is suspected to have the non-infectious or dormant phase of TB. The recommendation to treat LTBI is based on a clinical assessment of the patient looking at risks for progression to active TB. Not everyone with LTBI is offered or needs treatment.

In 2014, 802 total clients started LTBI therapy. A total of 77.7% of those starting treatment completed treatment satisfactorily in 2014 (Table 4). Of those starting treatment in 2014, 43.5% were aged 40-59, 27.0% were greater than 60, and 19.4% were 30-39 (Figure 18). In 2014, 73.4% of those starting LTBI treatment were among foreign-born, 16.7% were among Canadian-born non-Aboriginals, and 7.6% were among Aboriginal; 1.2% were of unknown origin or had missing data.

Of those failing to satisfactorily complete treatment in 2014, 7.5% did so for reasons that are not amenable to intervention (drug reaction, death from any cause, and leaving the province), down from 9.2% in 2013. In 2014, 11.6% failed to complete LTBI treatment for reasons that can potentially be improved with additional public health intervention (non-adherence, lost to follow up), down from 13.7% in 2013 (Table 4). Of those failing to complete treatment in 2014, the most common reasons were: 6.0% had a documented adverse drug reactions, 5.2% were lost to follow-up, and 2.6% were non-adherent. The percentage of cases with adverse drug reactions decreased over the last 3 years from 11.3% in 2011 (Table 4). Of those starting treatment in 2013, 86.9% received self-administered treatment and 3.3% had directly observed preventative therapy.

Figure 18. Proportion of total LTBI treatment by age in BC for 2014

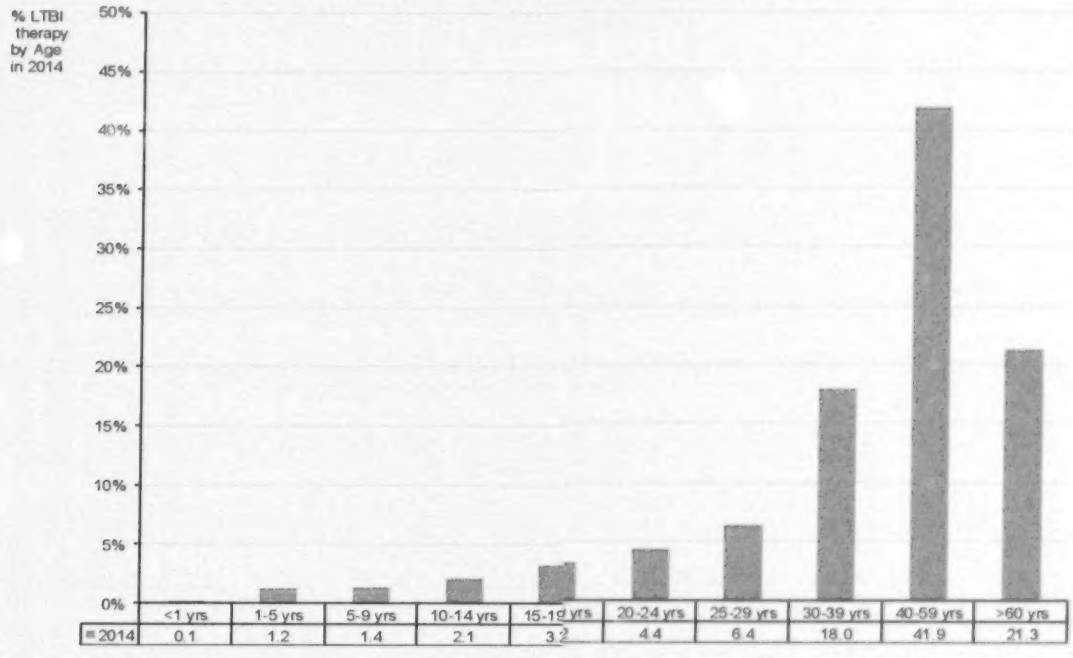


Table 4. Proportion of cases by LTBI treatment outcomes for 2010-2014

Treatment	2010	2011	2012	2013	2014
Satisfactory	71.5	71.8	73.6	75.6	77.7
Not Completed - Non Amenable to Intervention	10.1	13.3	11.8	9.2	7.5
Drug Reaction	8.8	11.3	9.6	7.5	6.0
Left Province	1.0	1.3	1.9	0.9	0.7
Death	0.3	0.6	0.2	0.9	0.7
Not Completed - Amenable to Intervention	17.3	14.2	13.3	13.7	11.6
Non Adherent	4.3	3.5	2.9	2.6	3.9
Lost to Follow-up	9.7	8.0	6.9	7.2	5.2
Incomplete - Other	2.9	2.7	3.5	3.9	2.5
Other	1.2	0.5	1.3	1.5	0.7
Not Finished	0.0	0.0	0.0	1.0	2.0
No Data	0.2	0.3	0.0	0.0	2.5
Total # of LTBI Treatment	1060	777	830	802	802

TB Contact Tracing

Notes Regarding the Interpretation of Contact Data

Contact tracing is an important public health intervention that involves identifying individuals who may be at risk of having TB infection or active TB disease as a result of having shared air space with an active TB case. Not all person-to-person contact is equivalent, however, and contacts are classified and prioritized based on to the type of TB (in some cases), duration of contact, and contact risk factors. This data presented in this report is from iPHIS only and may be incomplete as regions may have separate databases for contact investigation and for the investigation of clusters/outbreaks. This section of the report provides data on contacts of known source cases diagnosed in BC (i.e., contacts identified as part of federally managed airplane screening or contacts of non-resident cases are not included).

Finally, patterns in the number of contacts are affected by the circumstances of each case and differences in the collection, entry and reporting of contact data. Provincial workflows for contact tracing and contact data entry changed in 2013, and should be considered when interpreting the provincial surveillance data presented here.

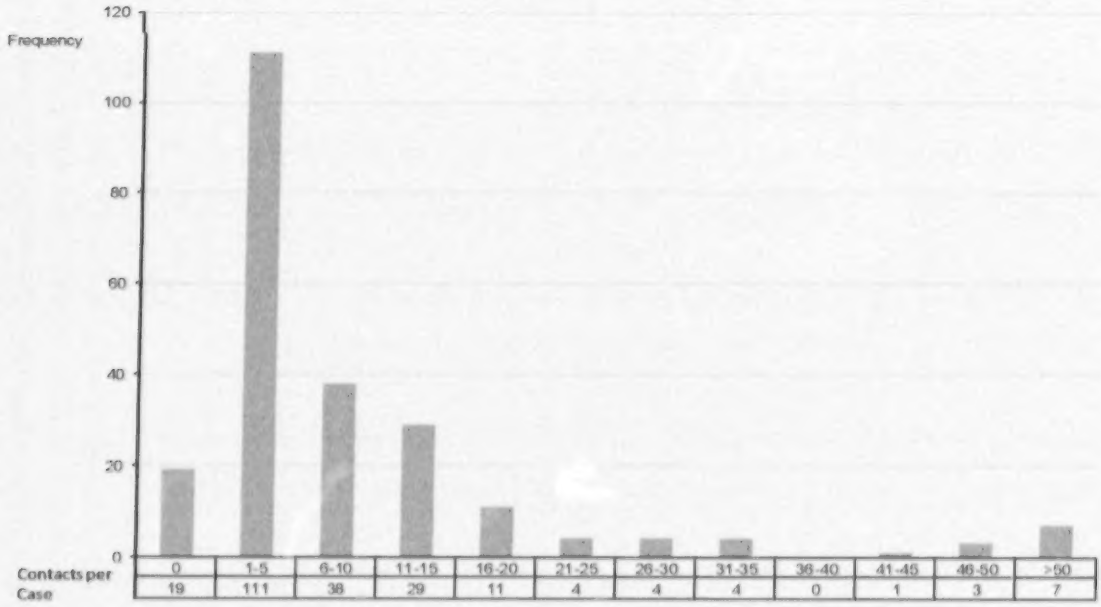
Contacts Per Case

In 2014, a total of 2295 contacts were associated with active cases, down from 4404 in 2013. Of the contacts associated with active cases in 2014, 2187 were contacts of respiratory cases. Of these, only 1903 had detailed information documented in iPHIS (and will be the focus of the next sections of the report).

In 2014, 19 respiratory cases had no documented contacts in iPHIS, up from 13 in 2013; these individuals were excluded from summary calculations. The mean number of contacts per respiratory TB case (primary, pulmonary, miliary, and other respiratory) in 2014 was 10.3 (median=5.0), down from 19.9 (median=11) in 2013. The maximum number of contacts associated with a single respiratory case was 182 and 97 in 2013 and 2014, respectively.

The median number of contacts of respiratory cases in 2014 was 22.9 in TB cases among Aboriginal peoples, 16.1 in cases among Canadian born, and 8.4 in foreign-born cases. Approximately 65% of respiratory cases (with at least 1 contact) in 2014 had 10 or fewer listed contacts. Seven individuals had >50 contacts (Figure 19).

Figure 19. Histogram of number of contacts per respiratory source case in 2014



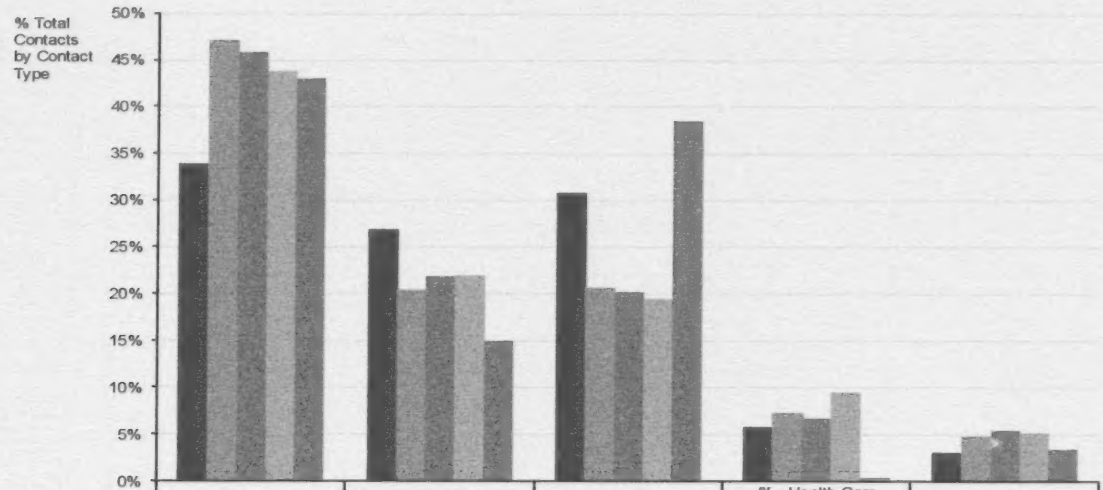
2014

Contact by Type

Contacts are grouped according to the intensity of the exposure; Type 1 are household contacts or those sharing airspace for 4 hours per week, Type 2 contacts are non-household contacts or those sharing air space for 2-4 hours per week, and Type 3 are casual contacts or those sharing airspace for less than 2 hrs per week.[9]

In 2014, 43.0% of all contacts (including individuals listed more than once) were classified as Type 1, 14.9% were Type 2, and 38.4% were Type 3 (Figure 20).

Figure 20. Percentage of total contacts by contact type for BC in 2010-2014



	% - Type 1	% - Type 2	% - Type 3	% - Health Care Setting	% - Other
2010	33.9	26.8	30.6	5.7	3.0
2011	47.1	20.4	20.6	7.2	4.8
2012	45.8	21.9	20.2	6.7	5.4
2013	43.9	21.9	19.5	9.5	5.1
2014	43.0	14.9	38.4	0.4	3.4

*The results presented here are heavily affected by provincial and regional contact management practices.

Endnotes

[1] For identification of high risk countries, see the "Designated Country/Territory List. Ottawa: Citizenship and Immigration Canada, 2011." Retrieved from: http://www.cic.gc.ca/english/information/medical/dcl.asp

[2] For further discussion of the historic factors that contribute to inequities in the social determinants of health among Aboriginal people see: BC Provincial Health Officer. (2009). Pathways to Health and Healing: 2nd Report on the Health and Well-being of Aboriginal People in British Columbia. Provincial Health Officer's Annual Report 2007. Retrieved from http://www.health.gov.bc.ca/pho/reports/annual.html

[3] Additional information on the multiple historic factors contributing to the inequities in the social determinants of health among Aboriginal people see: Orr PH, Case C, Mersereau T, Lem M. Tuberculosis control in First Nations and Inuit Populations. In: Long R, Ellis E, editors. The Canadian Tuberculosis Standards. 6th ed. Ottawa (Canada): Canadian Lung Association and Health Canada; 2007. p. 298-308.

[4] Public Health Agency of Canada. Tuberculosis in Canada 2011 - Pre-Release. In: Minister of Public Works and Government Services Canada, editor. Ottawa, Canada 2012.

[5] Canada. Facts and Figures: Immigration Overview Permanent and Temporary Residents. Ottawa, Ontario: Research and Evaluation Branch, Citizenship and Immigration Canada; 2011.

[6] For a description of immigrant screening practices, see: Gushulak B, Martin S. Immigration and Tuberculosis Control. In: Long R, Ellis E, editors. The Canadian Tuberculosis Standards. 6th ed. Ottawa (Canada): Canadian Lung Association and Health Canada; 2007. p. 298-307.

[7] Long R, Schwartzman K. Transmission and Pathogenesis of Tuberculosis. In: Long R, Ellis E, editors. The Canadian Tuberculosis Standards. 6th ed. Ottawa (Canada): Canadian Lung Association and Health Canada; 2007. p. 37-52.

[8] Zignol, Matteo et al. Surveillance of anti-tuberculosis drug resistance in the world: an updated analysis, 2007-2010. *Bull World Health Organ* [online]. 2012, vol.90, n.2 [cited 2013-05-15], pp. 111-119 .

[9] TB Manual for Professionals to Help Manage TB. BCCDC; 2011. pg. 43. Retrieved from: http://www.bccdc.ca/NR/rdonlyres/57623012-34A9-4886-9B6D-00D8576BA190/0/TB_Manual_BCCDC_June2010.pdf

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2014

Technical Appendix

Data Limitations

There are several key limitations to surveillance data which are important to understand in order to interpret surveillance data appropriately.

- All TB surveillance data comes from the Integrated Public Health Information System (iPHIS). This system was implemented in 2003. This report only includes data from 2003-2013 to minimize data quality issues stemming from the transition from the previous TB Clinical Data system to iPHIS.
- All geographic breakdowns reflect place of residence at time of diagnosis or time of treatment. Subsequent movement is not reflected in this report.
- Active TB case data, LTBI data and contact data was extracted iPHIS on March 12th, 2016. iPHIS data may be modified after data extraction as additional laboratory or clinical findings become available; such changes will not be reflected in this report.
- Active TB case totals may differ from those reported by the Public Health Agency of Canada (PHAC). PHAC excludes cases diagnosed in temporary BC residents (visitors, students, and people granted work permits), while the BCCDC includes these cases in provincial totals.
- Active TB is rare in BC. Rates or proportion over time for some indicators may reflect minor differences in small numbers, and not meaningful changes in the underlying disease process.
- Tuberculin skin test (TST) data is entered in both the TB module by TB-Services and into the Public Health module by our Health Authority partners. This may result geographic differences in patterns of data entry. Furthermore, negative TST results are not routinely documented in iPHIS; we are therefore unable to provide information on the proportion of TST<9mm and the total number of TST performed.
- Disease rates are not provided for Foreign-born individuals by PHAC region groupings because we lack accurate denominator data for country groups in BC.
- The contact information presented here includes only contacts of source cases identified in BC; the data presented does not include contacts identified as part of federal airplane screening, or contacts of sources cases not located in BC. As a result, the data presented does not reflect the full workload of contact tracing teams.
- Contact information is documented in two places in iPHIS: a summary of the total number of contacts is assigned to each active cases, with individual contact information entered elsewhere in the system. However, not all contacts have their individual level information entered in the system. All contact averages are based on the summary measure, while details about specific contact characteristics (e.g. contact type, origin, etc.) are based on the individual level data.

Case Definitions

A. Active TB

Detection and confirmation of *Mycobacterium tuberculosis* complex or clinical presentation compatible with tuberculosis.

Laboratory confirmed case

- Cases with *Mycobacterium tuberculosis* complex isolated by culture from a clinical specimen, specifically *M. tuberculosis*, *M. africanum*, *M. canetti*, *M. caprae*, *M. microti*, *M. pinnipedii* or *M. bovis* (excluding *M. bovis* BCG strain).

Clinically confirmed case

- In the absence of culture proof, cases clinically compatible with active tuberculosis. For example:
- chest x-ray changes compatible with active tuberculosis;
- Clinical symptoms and/or signs of nonrespiratory tuberculosis (meningeal, bone, kidney, peripheral lymph nodes etc.);
- Histopathologic or post-mortem evidence of active tuberculosis
- Favorable response to therapeutic trial of antituberculosis drugs.

New active case

Incident case of active TB with no documented evidence or adequate history of previously active tuberculosis.

Reactivation case

The development of active disease after a period of latent tuberculosis infection.

Retreatment case

A re-treatment case of tuberculosis has current active disease and historic documentation of previous active disease. Note that: (1) the client does not currently need to be on treatment, (2) the client did not have to receive previous treatment, and (3) previous treatment did not have to occur in BC.

Drug Resistance

Active cases are classified as resistant to rifampin, isoniazid, or both. Resistance to other TB medication is not reported here.

B. Site of Disease

The main diagnostic site is determined by the following hierarchy: primary, pulmonary, other respiratory and extrapulmonary TB [miliary/disseminated, meninges/central nervous system (CNS), peripheral lymph node and other sites].

Respiratory TB

Primary

This includes primary respiratory tuberculosis and tuberculous pleurisy in primary progressive tuberculosis due to infection within the last 24 months (ICD-9 codes 010.0, 010.1, 010.8, 010.9; ICD-10 codes 015.7, 016.7).

Pulmonary
Includes tuberculosis of the lungs and conducting airways, which includes tuberculous fibrosis of the lung, tuberculous bronchiectasis, tuberculous pneumonia, tuberculous pneumothorax, isolated tracheal or bronchial tuberculosis and tuberculous laryngitis (ICD-9 codes 011-011.9, 012.2, 012.3; ICD-10 codes A15.0-A15.3, A15.5, A15.9, A16.0-A16.4, A16.9).

Other respiratory
Includes tuberculous pleurisy (nonprimary) and TB of intrathoracic lymph nodes (hilar, mediastinal, tracheobronchial), nasopharynx, nose (sputum) and sinus (any nasal) (ICD-9 codes 012.0, 012.1, 012.8; ICD-10 codes 015.4, 015.6, 015.8, 016.3, 016.5, 016.8).

Miliary/disseminated
Includes blood-borne disseminated or generalized tuberculosis whether of a single specified site, multiple sites or unspecified site (ICD-9 codes 018.0- 018.9; ICD-10 codes 019.0-019.9).

Non-Respiratory TB

Any extrapulmonary site may be involved, but the most common site is peripheral lymph nodes (as defined below).

Meninges/Central Nervous System (CNS)
Includes tuberculosis of meninges (cerebral or spinal), tuberculoma of meninges, tuberculoma or abscess or tuberculosis of brain, CNS unspecified (ICD-9 codes 013.0-013.9, ICD-10 codes 017.0-017.9).

Peripheral Lymph Node
Includes tuberculosis of peripheral lymph nodes but excludes intrathoracic, mesenteric and retroperitoneal lymph nodes (ICD-9 code 017.2; ICD-10 code 018.2).

Other non-respiratory
Includes tuberculosis of all other sites: intestine, peritoneum, mesenteric glands; bones and joints (including vertebral column), genitourinary system; other organs such as skin, eye, ear, thyroid, adrenal gland, spleen, heart, other (ICD-9 all other ICD-9 codes; ICD-10 all other ICD-10 codes).

C. Latent Tuberculosis Infection (LTBI)

The clinical definition for LTBI is based on a complex mix of demographic characteristics and the presence of co-morbidities[10]. The clinical definition of LTBI is impractical for surveillance purposes because it cannot be determine based solely on current surveillance data. As a surrogate, we use a combination of TST and IGRA testing results to provide an estimate of LTBI for the TB annual report. Specifically, LTBI is defined as: 1) Positive TST>9mm with no confirmatory IGRA follow-up, 2) TST>9mm with confirmatory IGRA if subsequent testing was completed, 3) IGRA positive with no documented TST (see Figure. 32).

Data Sources

Integrated Public Health Information System (iPHIS)

All data presented in this report is extracted from the iPHIS. This is the only database used in the creation of this report. This system was implemented in BC in 2003.

Population Data

Population data for 1993-2014 is based on BC Stats population Estimates Database http://www.bcstats.gov.bc.ca/StatisticsBySubject/Demography/PopulationEstimates.aspx.

First Nations Population Estimates

Population rates for First Nations people are calculated using estimates from Aboriginal Affairs and Northern Development Canada (AANDC, formerly INAC: http://www.aadnc-aandc.gc.ca/).

These estimates are based on the Indian Register, which is subject to several limitations, including:

- Under-counting due to delayed reporting of infants entitled to be registered
- Over-counting due to individuals remaining on the Register after they are deceased
- Individuals are included in the BC population by whether they are a member of a BC band and not where they actually live
- Systematic biases from imbalance in the migration into and out of the British Columbia region (these are difficult to quantify)

For further details about the data source and its limitations, see the report entitled *Registered Indian Population by Sex and Residence, 2014*. Aboriginal Affairs and Northern Development Canada.

Additional Notes

Classification of Health Region

Cases are assigned to health regions (i.e., Health Authority or Health Service Delivery Area (HSDA)) by residence. If residence is unknown, the case is assigned to the health region where the individual was diagnosed or screened.